

WHAT IS CLAIMED IS:

1. A metallocene compound represented by the following general formula (1):



5 wherein

M represents a titanium atom, a zirconium atom or a hafnium atom;

Y represents a linking group bridging K and L and is a methylene group, an ethylene group, a tetraalkylethylene group having alkyl of 1-6 carbon atoms, a dialkylmethylene group having alkyl of 1-6 carbon atoms, a divalent linking group containing within a backbone thereof, an aryl group of 6-16 carbon atoms or a halogenated aryl group of 6-16 carbon atoms, or a divalent linking group containing a silicon atom, a germanium atom, an oxygen atom, a nitrogen atom, a phosphorous atom or a boron atom, or alternatively, Y represents a divalent linking group formed by connecting in series at least two linking groups selected from the foregoing linking groups;

20 q is an integer representing the number of Y and is 0, 1 or 2;

L represents a ligand having a conjugated 5-membered ring skeleton that is coordinated to M;

25 K may be the same as or different from L and represents a ligand having a conjugated 5-membered ring skeleton that is coordinated to M, or alternatively, when q is 1, K may be -NH- (N represents a nitrogen atom and H represents a

hydrogen atom) or may be -PH- (P represents a phosphorous atom and H represents a hydrogen atom);

at least one hydrogen atom of the hydrogen atoms possessed by K or by L is each independently replaced by an alkyl

5 group of 1-10 carbon atoms, a halogen-containing alkyl group of 1-10 carbon atoms, a silicon-containing alkyl group of 1-10 carbon atoms, an aryl group of 6-16 carbon atoms, a halogen-containing aryl group of 6-16 carbon atoms, an

alkenyl group of 2-10 carbon atoms, an arylalkyl group of 7-

10 40 carbon atoms, an alkylaryl group of 7-40 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms, a siloxyl group, an alkoxyl group, a halogen atom, an amino group, a

dialkyl-substituted amino group, a heterocyclic group, a  $SR^a$  group (S represents a sulfur atom and  $R^a$  represents a

15 halogen atom, an alkyl group of 1-10 carbon atoms or an aryl group of 6-16 carbon atoms), or a  $PR^b_2$  group (P represents a phosphorous atom; and two  $R^b$ s may be the same or different

and each represents a halogen atom, an alkyl group of 1-10 carbon atoms or an aryl group of 6-16 carbon atoms), with

20 the proviso that when each of K and L represents a ligand having a conjugated 5-membered ring skeleton, at least one substituent having replaced the hydrogen in either of the ligands does not exist at the corresponding position of the other ligand; and

25 two Xs may be the same or different and each represents a halogen atom, an alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms, an alkylaryl group having alkyl

of 1-6 carbon atoms and aryl of 6-16 carbon atoms, or an arylalkyl group having aryl of 6-16 carbon atoms and alkyl of 1-6 carbon atoms, which atom or group is bonded to M, provided that dimethylsilylene(2-methyl-benzoindenyl)(2-methyl-4-(2-furyl)-indenyl)zirconium dichloride and dimethylsilylene(2-methyl-4-phenylindenyl)(2-methyl-4-(2-furfuryl)-indenyl)zirconium dichloride are excluded.

2. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents a ligand having a conjugated 5-membered ring skeleton; q is 1; at least the substituents at the 2-positions of K and L differ from each other, or at least the substituents at the 4-positions of K and L differ from each other, or at least both of the substituents at the 2-positions and the substituents of the 4-positions of K and L differ respectively between the two ligands.

3. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents a ligand having a conjugated 5-membered ring skeleton; q is 1; at least the substituents at the 2-positions of K and L differ from each other; and at least one of said substituents is an aryl group of 6-16 carbon atoms, a halogen-containing aryl group of 6-16 carbon atoms, an alkylaryl group of 7-40 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms or a heterocyclic group.

4. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents a ligand having a conjugated 5-membered ring skeleton; q is 1; and at least the

5 substituents at the 2-positions of K and L differ from each other, and the difference between the numbers of carbon atoms in the two substituents is in the range of from 3 to 10.

5. The metallocene compound according to any one of  
10 claims 1-4, wherein in the general formula (1) according to claim 1, each of K and L represents a ligand having a conjugated 5-membered ring skeleton; q is 1; and at least the 4-position of at least one ligand between the two ligands K and L is an alkyl group of 1-10 carbon atoms, a  
15 halogen-containing alkyl group of 1-10 carbon atoms, a silicon-containing alkyl group of 1-10 carbon atoms, an alkenyl group of 2-10 carbon atoms, an arylalkyl group of 7-40 carbon atoms, an alkylaryl group of 7-40 carbon atoms, a siloxyl group, an alkoxy group, a halogen atom, an amino  
20 group, a dialkyl-substituted amino group, a heterocyclic group, a  $SR^a$  group (S represents a sulfur atom and  $R^a$  represents a halogen atom, an alkyl group of 1-10 carbon atoms or an aryl group of 6-16 carbon atoms), or a  $PR^b_2$  group (P represents a phosphorous atom; and two  $R^b$ s may be  
25 the same or different and each represents a halogen atom, an alkyl group of 1-10 carbon atoms or an aryl group of 6-16 carbon atoms).

6. The metallocene compound according to claim 1,  
wherein in the general formula (1) according to claim 1,  
while at least one of the hydrogen atoms possessed by K may  
be each independently replaced by an alkyl group of 1-6  
carbon atoms, a halogen-containing alkyl group of 1-6 carbon  
atoms, a silicon-containing alkyl group of 1-6 carbon atoms,  
an aryl group of 6-16 carbon atoms, a 2-furyl group, a  
substituted 2-furyl group, a 2-thienyl group, a substituted 2-  
thienyl group, a 2-furfuryl group, a substituted 2-  
furfuryl group, a siloxyl group or an alkoxyl group, at  
least one of the hydrogen atoms possessed by K is replaced  
by a 2-furyl group, a substituted 2-furyl group, a 2-thienyl  
group, a substituted 2-thienyl group, a 2-furfuryl group or  
a substituted 2-furfuryl group; and at least one of the  
hydrogen atoms possessed by L may be each independently  
replaced by an alkyl group of 1-6 carbon atoms, a silicon-  
containing alkyl group of 1-6 carbon atoms, a halogen-  
containing alkyl group of 1-6 carbon atoms, an aryl group of  
6-16 carbon atoms, a siloxyl group or an alkoxyl group.

7. The metallocene compound according to claim 6,  
wherein in the general formula (1) according to claim 1, K  
and L may be the same or different and each represents a  
ligand having a conjugated 5-membered ring skeleton; and Y  
represents a methylene group, an ethylene group, a  
tetraalkylethylene group having alkyl of 1-6 carbon atoms, a

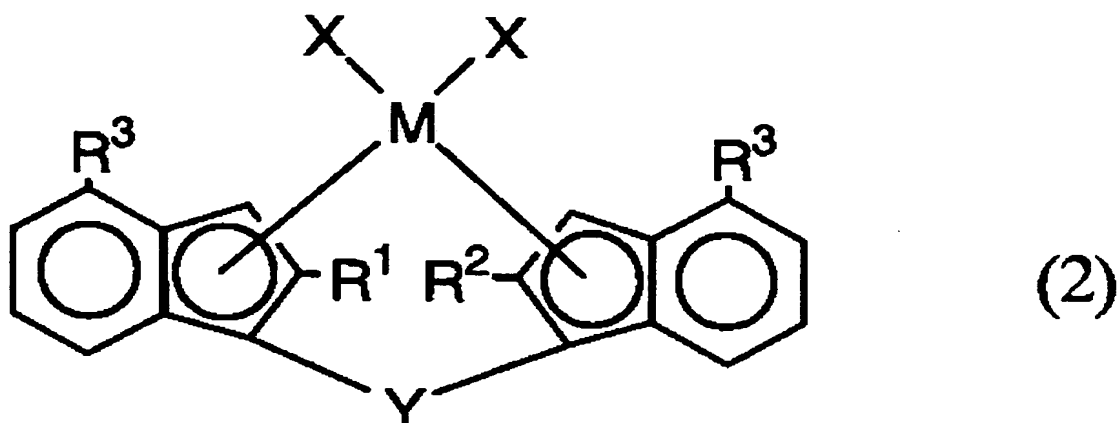
dialkylmethylene group having alkyl of 1-6 carbon atoms, or a divalent linking group containing a silicon atom, a germanium atom, an oxygen atom, a nitrogen atom, a phosphorous atom or a boron atom.

5        8.            The metallocene compound according to claim 7, wherein in the general formula (1) according to claim 1, q is 0 or 1.

10       9.            The metallocene compound according to any one of claims 1-8, wherein in the general formula (1) according to claim 1, K and L may be the same or different and each represents a cyclopentadienyl group, an indenyl group, a benzoindenyl group, a fluorenyl group, a tetrahydroindenyl group, an azulenyl group, a tetrahydroazulenyl group or a cyclopentaphenanthrnyl group.

15       10.           The metallocene compound according to any one of claims 1-8, wherein in the general formula (1) according to claim 1, each of K and L represents an indenyl group.

20       11.           The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents an indenyl group and has  $R^1$  or  $R^2$  at the 2-position and  $R^3$  at the 4-position of the indenyl group, represented by the following formula (2):



wherein  $R^1$  represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms;  $R^2$  represents an aryl group of 6-16 carbon atoms, an alkyl group of 4-6 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms or a heterocyclic group, provided that  $R^1$  and  $R^2$  are always different; and two  $R^3$ s may be the same or different and each represents a hydrogen atom, an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms, a halogen-containing aryl group of 6-16 carbon atoms, a 2-furyl group, a substituted 2-furyl group, a 2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

12. The metallocene compound according to claim 11, wherein in the general formula (2) according to claim 11,  $R^2$  represents a 2-furyl group, a substituted 2-furyl group, a

2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

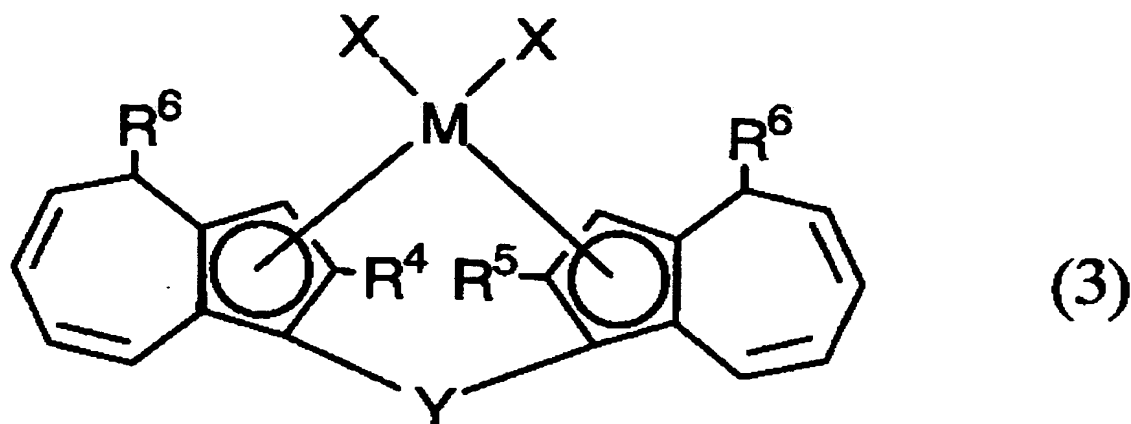
13. The metallocene compound according to claim 11, wherein in the general formula (2) according to claim 11, R<sup>1</sup> represents an alkyl group of 1-6 carbon atoms and R<sup>2</sup> represents a 2-furyl group or a substituted 2-furyl group.

14. The metallocene compound according to any one of claims 11-13, wherein in the general formula (2) according to claim 11, two R<sup>3</sup>s may be the same or different and each represents an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms.

15. The metallocene compound according to any one of claims 1-8, wherein in the general formula (1) according to claim 1, each of K and L represents an azulenyl group.

16. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents an azulenyl group and has R<sup>4</sup> or R<sup>5</sup> at the 2-position and R<sup>6</sup> at the 4-position of the azulenyl group, represented by the following formula (3):





wherein  $R^4$  represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms;  $R^5$  represents an aryl group of 6-16 carbon atoms, an alkyl group of 2-6 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms or a heterocyclic group, provided that  $R^4$  and  $R^5$  are always different; and two  $R^6$ 's may be the same or different and each represents a hydrogen atom, an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms, a halogen-containing aryl group of 6-16 carbon atoms, a 2-furyl group, a substituted 2-furyl group, a 2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

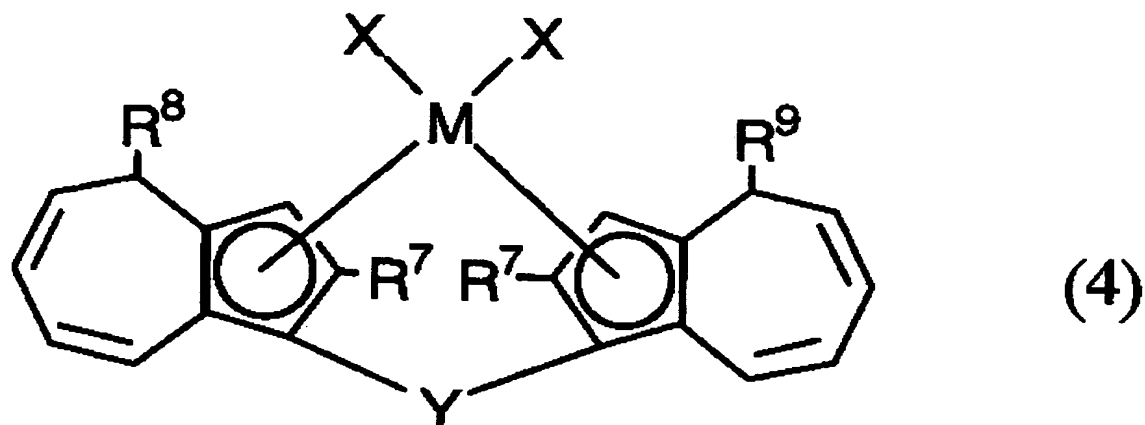
17. The metallocene compound according to claim 16, wherein in the general formula (3) according to claim 16,  $R^4$

represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; and R<sup>5</sup> represents a 2-furyl group, a substituted 2-furyl group, a 2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

18. The metallocene compound according to claim 16, wherein in the general formula (3) according to claim 16, R<sup>4</sup> represents an alkyl group of 1-6 carbon atoms and R<sup>5</sup> represents a 2-furyl group or a substituted 2-furyl group.

19. The metallocene compound according to any one of claims 16-18, wherein in the general formula (3) according to claim 16, two R<sup>6</sup>s may be the same or different and each represents an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms.

20. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents an azulenyl group and has R<sup>7</sup> at the 2-position and R<sup>8</sup> or R<sup>9</sup> at the 4-position of the azulenyl group, represented by the following formula (4):



wherein two R<sup>7</sup>s may be the same or different and each represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; R<sup>8</sup> represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; and R<sup>9</sup> represents an aryl group of 6-16 carbon atoms, an alkyl group of 2-6 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms or a heterocyclic group, provided that R<sup>8</sup> and R<sup>9</sup> are always different.

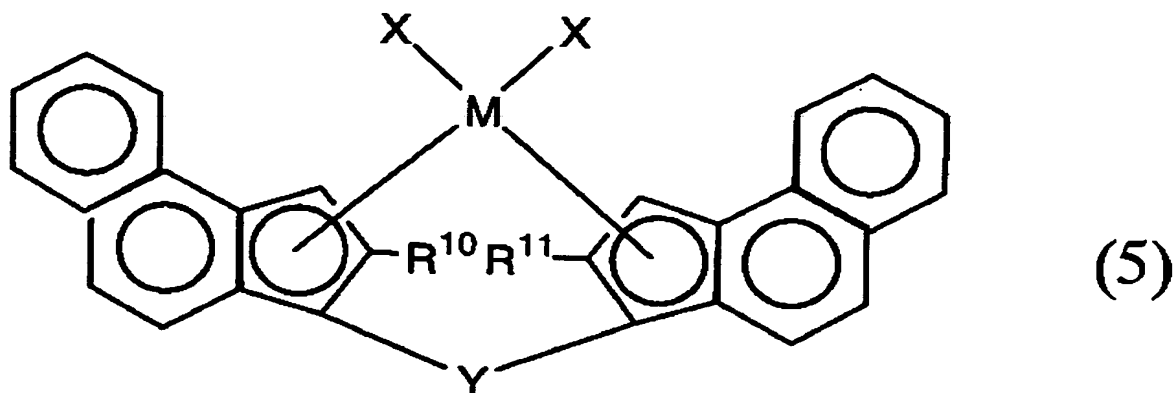
21. The metallocene compound according to claim 20, wherein in the general formula (4) according to claim 20, R<sup>8</sup> represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a silicon-

containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; and R<sup>9</sup> represents a 2-furyl group, a substituted 2-furyl group, a 2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

22. The metallocene compound according to claim 20, wherein in the general formula (4) according to claim 20, two R<sup>7</sup>'s may be the same or different and each represents an alkyl group of 1-6 carbon atoms; R<sup>8</sup> represents an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; and R<sup>9</sup> represents a 2-thienyl group or a substituted 2-thienyl group.

23. The metallocene compound according to any one of claims 1-8, wherein in the general formula (1) according to claim 1, each of K and L represents a benzoindenyl group.

24. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents a benzoindenyl group and has R<sup>10</sup> or R<sup>11</sup> at the 2-position of the benzoindenyl group, represented by the following formula (5):

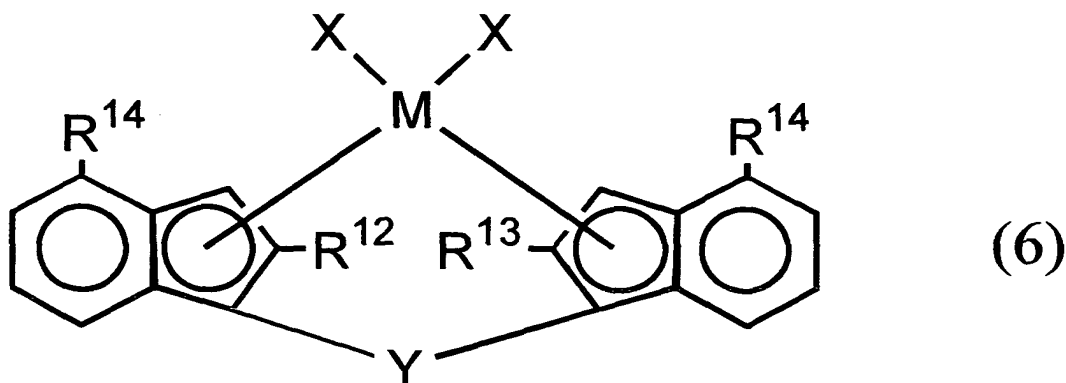


wherein  $R^{10}$  represents an alkyl group of 1-6 carbon atoms, a halogen-containing alkyl group of 1-6 carbon atoms, a  
 5 silicone-containing alkyl group of 1-6 carbon atoms, an aryl group of 6-16 carbon atoms or a halogen-containing aryl group of 6-16 carbon atoms; and  $R^{11}$  represents an aryl group of 6-16 carbon atoms, an alkyl group of 2-6 carbon atoms, an alicyclic hydrocarbon group of 3-16 carbon atoms or a  
 10 heterocyclic group, provided that  $R^{10}$  and  $R^{11}$  are always different.

25. The metallocene compound according to claim 24, wherein in the general formula (5) according to claim 24,  $R^{11}$  represents a 2-furyl group, a substituted 2-furyl group,  
 15 a 2-thienyl group, a substituted 2-thienyl group, a 2-furfuryl group or a substituted 2-furfuryl group.

26. The metallocene compound according to claim 1, wherein in the general formula (1) according to claim 1, each of K and L represents a benzoindenyl group and has  $R^{12}$   
 20 or  $R^{13}$  at the 2-position and  $R^{14}$  at the 4-position of the

benzoindenyl group, represented by the following formula  
(6):



wherein  $R^{12}$  represents an alkyl group of 1-3 carbon atoms;  
 $R^{13}$  represents an alkyl group of 2-3 carbon atoms provided  
that  $R^{12}$  and  $R^{13}$  are always different; two  $R^{14}$ s may be the  
same or different and each represents an aryl group of 6-16  
carbon atoms, a halogen-containing aryl group of 6-16 carbon  
atoms, a 2-furyl group, a substituted 2-furyl group, a 2-  
thienyl group, a substituted 2-thienyl group, a 2-furfuryl  
group or a substituted 2-furfuryl group, with the proviso  
that the two  $R^{14}$ s cannot be either an aryl group of 6-16  
carbon atoms or a halogen-containing aryl group of 6-16  
carbon atoms at the same time.

27. A process for the production of an olefin polymer  
which comprises using an olefin polymerization catalyst  
containing the metallocene compound according to any one of  
claims 1-26, an activating compound and, optionally, an  
organoaluminum compound.

28. A process for the production of an olefin polymer which comprises using an olefin polymerization catalyst containing (A) a supported catalyst component that is prepared from the metallocene compound according to any one of claims 1-26, an activating compound, a support in the form of finely divided particles and, optionally, an organoaluminum compound, together with (B) an organoaluminum compound.

29. A process for the production of an olefin polymer which comprises using an olefin polymerization catalyst containing (A) a supported catalyst component that is prepared from the metallocene compound according to any one of claims 1-26, an ion-exchangeable layer compound or an inorganic silicate and, optionally, an organoaluminum compound, together with (B) an organoaluminum compound.

30. An olefin polymer produced by a process for the production of an olefin polymer according to any one of claims 27-29.

31. The olefin polymer according to claim 30, wherein the olefin polymer is a propylene/olefin copolymer comprising as structural units, a propylene unit and an olefin unit other than propylene and the content of the olefin unit other than propylene is 0.1-80 molar % based on the molar number of the structural units constituting the copolymer.

32.           The olefin polymer according to claim 31, wherein the olefin unit other than propylene is an ethylene unit or a 1-butene unit, or an ethylene unit and a 1-butene unit.